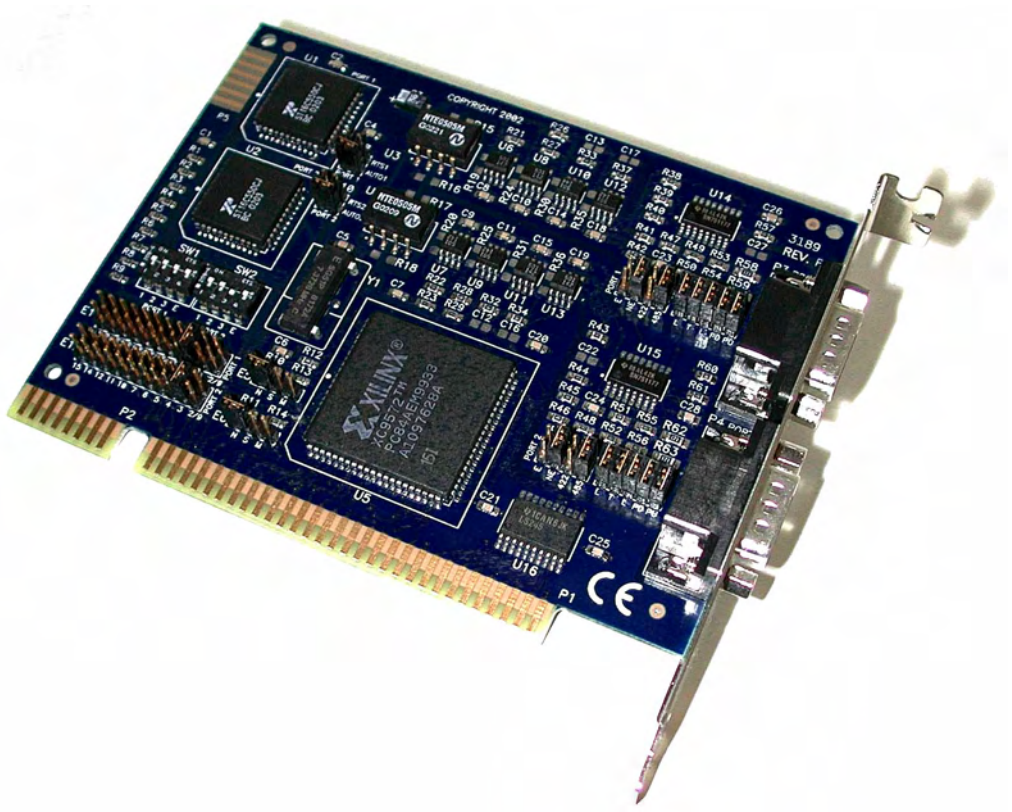
SEALEVEL
SYSTEMS INCORPORATED

Ultra-SIO
Users Manual



Part # 3089 and 3189

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Introduction

Overview

The Sealevel Systems **Ultra-SIO** provides the PC with two additional ground isolated RS-422/485 (P/N 3189) or two non-isolated RS-422/485 (P/N 3089) serial ports for terminals, modems, printers, etc. Isolation is important in installations where the equipment being connected to the PC is either far from the PC, or on a different power transformer circuit. Ground loop current is a commonly neglected and misunderstood phenomenon that leads to data loss and the possible destruction of communications interfaces. The isolated **Ultra-SIO** provides up to 500 volts DC of isolation.

What's Included

The **Ultra-SIO** is shipped with the following items. If any of these items are missing or damaged, contact the supplier.

- **Ultra-SIO** Serial I/O Adapter (P/N 3189 with isolation or P/N 3089 without isolation)
- Sealevel Software CD

Factory Default Settings

The **Ultra-SIO** factory default settings are as follows:

Port #	Base Address	IRQ	Electrical Specification
Port 1	3E8	5	RS-422
Port 2	2E8	10	RS-422

To install the **Ultra-SIO** using factory default settings, refer to Installation on page **Error! Bookmark not defined.**.

For your reference, record installed **Ultra-SIO** settings below:

Port #	Base Address	IRQ	Electrical Specification

Card Setup

The **Ultra-SIO** contains several jumper straps that must be set for proper operation.

Address Selection

Each port on the **Ultra-SIO** occupies eight consecutive I/O locations. A DIP-switch is used to set the base address for these locations. SW1 sets the I/O address for port 1 and SW2 sets port 2. The following table shows the addressing options available. If different address options are required, please contact Sealevel Systems Technical Support about a custom PAL option.

	1	2	3	4
3F8	On	On	On	On
2F8	On	On	Off	On
3E8	On	Off	On	On
2E8	On	Off	Off	On
2A0	Off	On	On	On
300	Off	On	Off	On
328	Off	Off	On	On
Disabled	Off	Off	Off	Off

Figure 1 - Address Selection Table

Note: Each COM: port in the system should have a unique address. Typically COM1: - COM4: addresses are 3F8, 2F8, 3E8 and 2E8 Hex.

Refer to Appendix A for common address contentions.

Port Enable / Disable

Each port on the **Ultra-SIO** can be enabled or disabled with switch position 4 on the DIP-switch. The port is enabled with the switch 'On' and disabled when 'Off'. If any port is disabled, be sure to disable the interrupt request for that port by removing the IRQ jumper.

IRQ Selection

Headers E11 and E12 select the interrupt request for each serial port. If COM1: is selected, the corresponding jumper must be on the IRQ4 setting. If COM2: is selected, the corresponding jumper must be on IRQ3.

Note: Most communications software applications default COM3: to IRQ4 and COM4: to IRQ3. This requires the sharing of interrupts between COM1: and COM3:, and between COM2: and COM4:. While this is the default, it is not always the preferred setting. Check your software configuration instructions to determine the most appropriate IRQ selection.

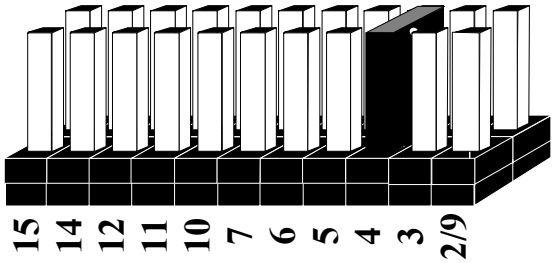


Figure 2 - Header E11 and E12, IRQ Selection

Any two or more ports can share a common IRQ by placing the jumpers on the same IRQ setting at header E11 and E12 and setting the appropriate selections at E5 and E6. Note that a polling type driver is needed to share interrupts in this fashion. Windows does not supply a polling type driver. Consult your particular software for IRQ selection. If no interrupt is desired, remove the jumper.

Interrupt Modes

Header E5 and E6 selects the interrupt mode for each port. Each port must be set in the correct mode to insure proper operation.

'**N**' indicates the (**N**)ormal, single interrupt per port mode. '**S**' Indicates the (**S**)hared interrupt mode, which allows more than one port to access a single IRQ. Any two or more ports can share a common IRQ by placing the jumpers on the same IRQ setting and setting the appropriate selections at E1. Consult your particular software for IRQ selection. If no interrupt is desired, remove the jumper. '**M**' indicates the inclusion of a 1K ohm pull-down resistor required on one port when sharing interrupts.

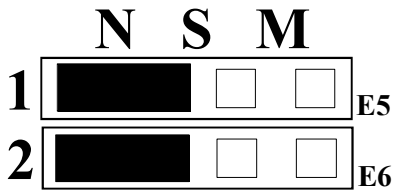


Figure 3 - Header E5 & E6, Normal IRQ Mode

Set the jumpers to '**S**' for shared interrupt mode on all blocks sharing an IRQ except one. Set that port block for '**M**'. This provides the pull-down resistor circuit that makes sharing IRQs possible. If you are using more than one **Ultra-SIO** or a compatible adapter in a bus you should only have one port set to '**M**'. The following example shows both ports sharing a single IRQ.

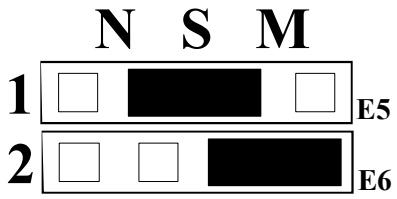


Figure 4 - Header E5 & E6, Shared IRQ Mode

Set the jumper to '**S**' if you are using more than one **Ultra-SIO** in a bus or to completely remove the pull-down resistor for hardware compatibility. **Setting the adapter in this configuration when it is not accompanied by a pull-down resistor will prevent the ports from triggering an interrupt**.

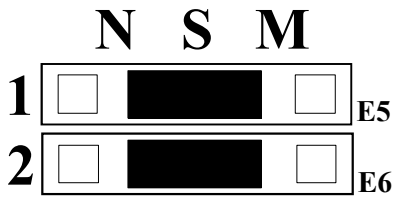


Figure 5 - Header E5 & E6, Sharing IRQs with another adapter

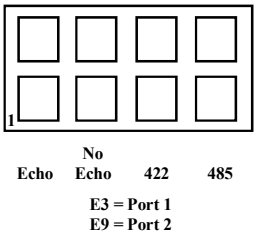
RS-485 Enable Modes

RS-485 is ideal for multi-drop or network environments. RS-485 requires a tri-state driver (not dual-state) that will allow the electrical presence of the driver to be removed from the line. The driver is in a tri-state or high impedance condition when this occurs. Only one driver may be active at a time and the other driver(s) must be tri-stated. The output modem control signal **R**equest **T**o **S**end (RTS) is typically used to control the state of the driver. Some communication software packages refer to RS-485 as RTS enable or RTS block mode transfer.

One of the unique features of the **Ultra-SIO** is the ability to be RS-485 compatible without the need for special software or drivers. This ability is especially useful in Windows, Windows NT, and OS/2 environments where the lower level I/O control is abstracted from the application program. This ability means that the user can effectively use the **Ultra-SIO** in a RS-485 application with existing (i.e. standard RS-232) software drivers.

Headers E8 (Port 1) and E10 (Port 2) are used to control the RS-485 mode functions for the driver circuit. The two selections are 'RTS' enable or 'Auto' enable. The 'Auto' enable feature automatically enables/disables the RS-485 interface. The 'RTS' mode uses the 'RTS' modem control signal to enable the RS-485 interface and provides backward compatibility with existing software products. If you have E3 and E9 in the RS-422 mode and wish to have the RTS signal present at the DB connector place a jumper over the RTS pins at E8 and E10. Otherwise the RTS control signal will not be present at the DB connector.

Headers E3 (Port 1) and E9 (Port 2) are used to control the RS-485 enable/disable functions for the receiver circuit and determine the state of the RS-422/485 driver. The RS-485 'Echo' is the result of connecting the receiver inputs to the transmitter outputs. Every time a character is transmitted; it is also received. This can be beneficial if the software can handle echoing (i.e. using received characters to throttle the transmitter) or it can confuse the system if the software does not. These header blocks are described in the illustration and table that follow:



Position 1 'Echo'	Echoes the data that is transmitted. All characters transmitted are received. (Only relevant in the two wire RS-485 Mode)
Position 2 'No Echo'	Inhibits the data that has been transmitted. Receiver is off when transmitter is on. (Only relevant in the two wire RS-485 Mode)
Position 3 '422'	RS-422/485 Driver always enabled (RS-422 Mode). RTS modem control signal available on DB-9 connector.
Position 4 '485'	RS-422/485 Driver enabled by RTS or 'Auto' enabled. Modem control signal not available on DB-9 connector.

Interface Mode Examples

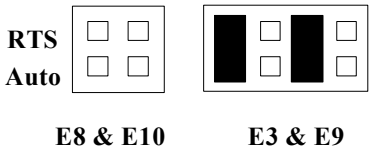


Figure 6 - RS-422

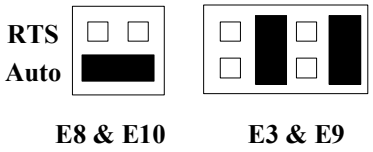


Figure 7 - RS-485 'Auto' Enabled, with 'No Echo'

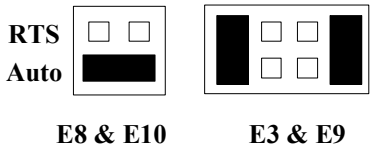


Figure 8 - RS-485 'Auto' Enabled, with 'Echo'

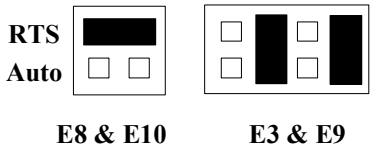


Figure 9 - RS-485 'RTS' Enabled, with 'No Echo'

Line Termination

Typically, each end of the RS-485 bus must have line terminating resistors (RS-422 terminates at the receive end only). A 120 ohm resistor is across each RS-530/422/485 input in addition to a 1K ohm pull-up/pull-down combination that bias the receiver inputs. Headers E1 and E4 allow the user to customize this interface to their specific requirements. Each jumper position corresponds to a specific portion of the interface. If multiple **Ultra-SIO** adapters are configured in a RS-485 network, only the boards on each end should have jumpers T, P & P **ON.** Refer to the following table for each position's operation:

Name	Function
L	Connects the TX+ to RX+ for RS-485 two wire operation.
T	Adds or removes the 120 ohm termination.
L	Connects the TX- to RX- for RS-485 two wire operation.
P	Adds or removes the 1K ohm pull-down resistor in the RS-422/RS-485 receiver circuit (Receive data only).
P	Adds or removes the 1K ohm pull-up resistor in the RS-422/RS-485 receiver circuit (Receive data only).

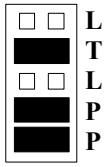


Figure 10 - Headers E1 and E4, Line Termination

Installation

Operating System Installation

Windows 95/98/ME/NT/2000/XP

Do not install the adapter in the machine until the software has been fully installed.

1. Start Windows.
2. Insert the Sealevel Systems CD in to your CD drive.
3. If 'Auto-Start' is enabled for this drive the software will automatically launch.
4. Otherwise, point your browser to the 'Index.htm' on the root of the CD
5. The next step is to select 'Install Software'.
6. Select the part number for your adapter from the listing.
7. Select 'Windows 95/98/ME/NT/2000/XP' then (depending on the OS version) select the 'Run from current Location' or 'Open' option. Follow the information presented on the screens that follow.
8. Run the Add/Remove Hardware utility located in Control Panel. Double click the icon to launch the Wizard. When the Choose Hardware Task appears choose Add/Troubleshoot a device. At that point Windows will search for Plug and Play devices. Since the ISA board is not Plug and Play it will not be found. If Windows finds something you were not expecting, cancel that install and click Next. When Choose a Hardware Device appears select Add a new device. Windows will then ask if you want it to search and you select No, I want to select the hardware from a list. Then click Next. After choosing Next you will see Hardware Type. If you are installing a single port serial card select Ports (COM & LPT). If you are installing a multiport serial card, (two or more ports), choose Multi-port serial adapters. Click Next. The Select a Device Driver window will appear. On the left side find Sealevel Systems, Inc. and on the right side of the window select the card type you are installing.
9. Windows will now show a warning message that it could not detect the settings of the device and that you must enter the settings manually. Click OK. The Add New Hardware Wizard Properties window will appear. This window will show the default settings for the I/O address and one IRQ. The one IRQ will mean that you will be sharing one IRQ for all ports on the board for a multi port card. You will only need one IRQ if installing a single port card. Since Windows cannot detect the settings there my be a conflict with another device or the settings shown may be not the settings you wish to use. To change the settings choose Basic configuration 0001 next to the heading Setting based on:. When this configuration is chosen the Resources window will appear with all question marks. Simply choose each Input/Output Range and IRQ and change the settings to match the board settings. Make sure there are no conflicts with other devices that would appear at the bottom of the window under Conflicting device list. After you have either accepted the default settings or changed the settings, the Start Hardware Installation window will appear. Click Next.
10. The next window that may appear will be the Digital Signature Not Found. Do not search for digitally signed software and continue with the installation. The Completing the Add/Remove Hardware Wizard window will appear. You will be given a chance to change the resource settings again at this point if necessary. Choose Finish. At this point you will need to restart your computer. After restarting the Found New Hardware window will appear for each port that you are installing. To confirm that the drivers installed you can now look in Device Manager under Ports (COM &LPT) and each of the ports should show with their corresponding COM number.

Linux

Refer to D:\software\seacom\Other\Linux**Linux.serial.readme** (where D: = your CDROM driver letter) found on the Sealevel Systems CD. This file contains valuable information on installing your adapter in the various Linux releases. Also in this sub-directory is the **Linux SerialHOWTO.** This series of files explains typical Linux serial implementations, as well as informing the user to Linux syntax and preferred practices.

QNX

Refer to D:\software\seacom\Other\QNX6**Install.readme** (where D: = your CDROM driver letter) found on the Sealevel Systems CD. This file contains valuable information on installing your adapter in the QNX6 Neutrino OS, as well as the files required to ensure a flawless implementation. Also provided on the Sealevel Systems CD are implementation instructions for QNX4. These are found in D:\software\seacom\Other\QNX4**QNX_COM.txt.**

Technical Description

The Sealevel Systems **Ultra-SIO** provides the PC with two additional ground isolated RS-422/485 (P/N 3189) or two non-isolated RS-422/485 (P/N 3089) serial ports for terminals, modems, printers, etc. Isolation is important in installations where the equipment being connected to the PC is either far from the PC, or on a different power transformer circuit. Ground loop current is a commonly neglected and misunderstood phenomena that leads to data loss and the destruction of communications interfaces. The **Ultra-SIO** isolated boards provide up to 500 volts DC of isolation.

The **Ultra-SIO** utilizes the 16550 UART. This chip features programmable baud rate, data format, interrupt control and a 16 byte input and output FIFO. A full array of UART upgrades is also available offering larger FIFO's. Contact technical support for details.

Features

- Automatic RS-485 driver enable/disable allows card to appear to be RS-232 requiring no additional drivers
- 'PAL' option allows for unique OEM address selection
- 'Shareable' IRQs allow more than one port to share a single IRQ providing a polling type driver is used.
- IRQs 2/9-7, 10, 11, 12, 14, 15 supported
- 16550 buffered UARTs Standard
- 16 Bit address decode allows for easier integration

Connector Pin Assignments (DB 9 MALE)

Signal	Name	Pin #	Mode
GND	Ground	5	
TX +	Transmit Data Positive	4	Output
TX-	Transmit Data Negative	3	Output
RTS+	Request To Send Positive	6	Output
RTS-	Request To Send Negative	7	Output
RX+	Receive Data Positive	1	Input
RX-	Receive Data Negative	2	Input
CTS+	Clear To Send Positive	9	Input
CTS-	Clear To Send Negative	8	Input

Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	0º to 70º C (32º to 158º F)	-50º to 105º C (-58º to 221º F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Manufacturing

All Sealevel Systems Printed Circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Power Consumption

Supply line	+5 VDC
Rating	600 mA

Physical Dimensions

Board length	7.35 inches	(18.67 cm)
Board Height including Goldfingers	4.2 inches	(10.66 cm)
Board Height excluding Goldfingers	3.9 inches	(9.91 cm)

Appendix A - Troubleshooting

Sealevel Software is supplied with the Sealevel Systems adapter and may be used in the troubleshooting procedures. Using this software and following these simple steps can eliminate most common problems without the need to call Technical Support.

1. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.

2. Configure your Sealevel Systems adapter so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address.

3. Make sure the Sealevel Systems adapter is using a unique IRQ. While the Sealevel Systems adapter does allow the sharing of IRQs, many other adapters (i.e. SCSI adapters & on-board serial ports) do not.

4. Make sure the Sealevel Systems adapter is securely installed in a motherboard slot.

5. When running DOS or Windows 3.x refer to the supplied Sealevel Software and this User Manual to verify that the Sealevel Systems adapter is configured correctly. This software contains a diagnostic program 'SSD' (D:\software\seacom\Other\DOS\DIAG, where D: = the driver letter of your CDROM drive) will verify if an adapter is configured properly. This diagnostic program is written with the user in mind and is easy to use

6. For Windows95/98/ME/NT/2000, the diagnostic tool 'WinSSD' is installed in the SeaCOM folder on the Start Menu during the setup process. First find the ports using the Device Manager, then use 'WinSSD' to verify that the ports are functional.

7. Remember that a loopback test is not possible with the 'No-Echo' selection enabled.

8. Always use the Sealevel Systems diagnostic software when troubleshooting a problem. This will eliminate any software issues from the equation.

Appendix B - How To Get Assistance

Please refer to Troubleshooting Guide prior to calling Technical Support.

1. Begin by reading through the Trouble Shooting Guide in Appendix A. If assistance is still needed please see below.
2. When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the adapter installed in a computer ready to run diagnostics.
3. Sealevel Systems provides an FAQ section on its web site. Please refer to this to answer many common questions. This section can be found at http://www.sealevel.com/faq.asp.
4. Sealevel Systems maintains a web page on the Internet. Our home page address is www.sealevel.com. The latest software updates, and newest manuals are available via our web site.
5. Technical support is available Monday to Friday from 8:00 a.m. to 5:00 p.m. eastern time. Technical support can be reached at (864) 843-4343.

Return Authorization Must Be Obtained From Sealevel Systems Before Returned Merchandise Will Be Accepted. Authorization Can Be Obtained By Calling Sealevel Systems And Requesting A Return Merchandise Authorization (RMA) Number.

Appendix C - Electrical Interface

RS-422

The RS-422 specification defines the electrical characteristics of balanced voltage digital interface circuits. RS-422 is a differential interface that defines voltage levels and driver/receiver electrical specifications. On a differential interface, logic levels are defined by the difference in voltage between a pair of outputs or inputs. In contrast, a single ended interface, for example RS-232, defines the logic levels as the difference in voltage between a single signal and a common ground connection. Differential interfaces are typically more immune to noise or voltage spikes that may occur on the communication lines. Differential interfaces also have greater drive capabilities that allow for longer cable lengths. RS-422 is rated up to 10 Megabits per second and can have cabling 4000 feet long. RS-422 also defines driver and receiver electrical characteristics that will allow 1 driver and up to 32 receivers on the line at once. RS-422 signal levels range from 0 to +5 volts. RS-422 does not define a physical connector.

RS-485

RS-485 is backwardly compatible with RS-422; however, it is optimized for partyline or multi-drop applications. The output of the RS-422/485 driver is capable of being **Active** (enabled) or **Tri-State** (disabled). This capability allows multiple ports to be connected in a multi-drop bus and selectively polled. RS-485 allows cable lengths up to 4000 feet and data rates up to 10 Megabits per second. The signal levels for RS-485 are the same as those defined by RS-422. RS-485 has electrical characteristics that allow for 32 drivers and 32 receivers to be connected to one line. This interface is ideal for multi-drop or network environments. RS-485 tri-state driver (not dual-state) will allow the electrical presence of the driver to be removed from the line. Only one driver may be active at a time and the other driver(s) must be tri-stated. RS-485 can be cabled in two ways, two wire and four wire mode. Two wire mode does not allow for full duplex communication, and requires that data be transferred in only one direction at a time. For half-duplex operation, the two transmit pins should be connected to the two receive pins (Tx+ to Rx+ and Tx- to Rx-). Four wire mode allows full duplex data transfers. RS-485 does not define a connector pin-out or a set of modem control signals. RS-485 does not define a physical connector.

Appendix D - Ground Loop Phenomenon

What is Ground Loop?

Ground loop Phenomenon occurs when two (or more) pieces of equipment are connected together with a common ground and a different ground potential exists at each location. This current can cause the connected equipment to experience noise that in turn causes data transmission errors. In the extreme this ground current can cause equipment malfunction or even destruction.

Cabling Recommendations

When connecting the **Ultra-SIO** in a RS-485 network, care should be taken that both ends of the network are not isolated from ground (see Figure 12). This "floating" ground condition could cause the capacitive or inductive coupling of voltages that will cause a break down in the DC to DC converter circuit or in the opto-isolator circuit. This condition will cause data errors and possibly destruction of the receiver circuit.

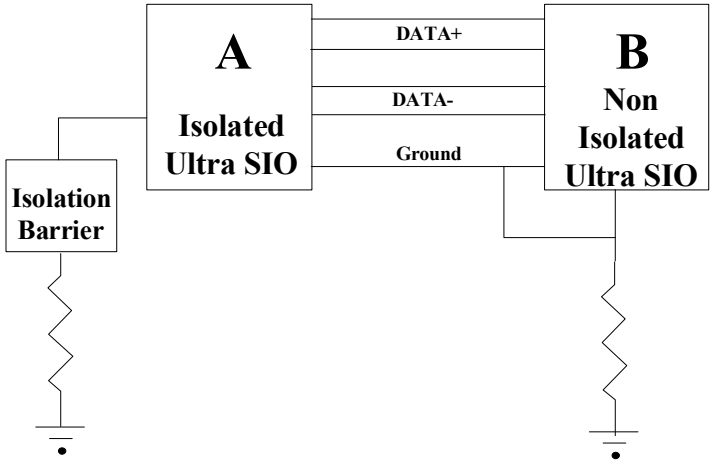


*Figure 11 - **Ultra-SIO** cabling example*

Appendix E - Asynchronous Communications

Serial data communications implies that individual bits of a character are transmitted consecutively to a receiver that assembles the bits back into a character. Data rate, error checking, handshaking, and character framing (start/stop bits) are pre-defined and must correspond at both the transmitting and receiving ends.

Asynchronous communications is the standard means of serial data communication for PC compatibles and PS/2 computers. The original PC was equipped with a communication or COM: port that was designed around an 8250 Universal Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. Character boundaries for asynchronous communications are defined by a starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8). The end of the character is defined by the transmission of a pre-defined number of stop bits (usually 1, 1.5 or 2). An extra bit used for error detection is often appended before the stop bits.

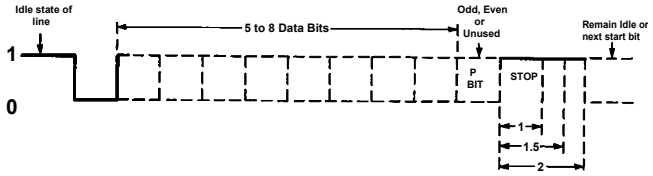
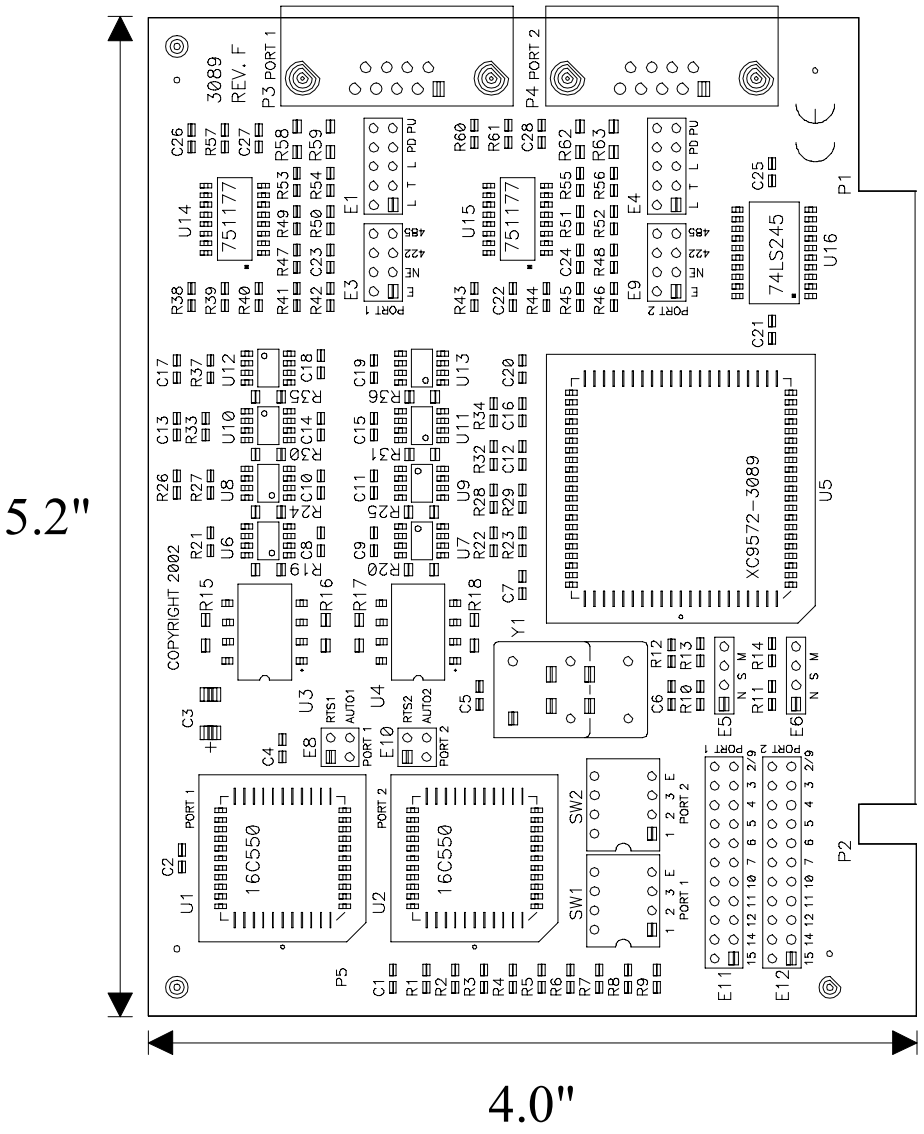


Figure 12 - Asynchronous Communications Bit Diagram

This special bit is called the parity bit. Parity is a simple method of determining if a data bit has been lost or corrupted during transmission. There are several methods for implementing a parity check to guard against data corruption. Common methods are called (E)ven Parity or (O)dd Parity. Sometimes parity is not used to detect errors on the data stream. This is refereed to as (N)o parity. Because each bit in asynchronous communications is sent consecutively, it is easy to generalize asynchronous communications by stating that each character is wrapped (framed) by pre-defined bits to mark the beginning and end of the serial transmission of the character. The data rate and communication parameters for asynchronous communications have to be the same at both the transmitting and receiving ends. The communication parameters are baud rate, parity, number of data bits per character, and stop bits (i.e. 9600,N,8,1).

Appendix F - Silk-Screen



Appendix G - Compliance Notices

Federal Communications Commission Statement

FCC - This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in such case the user will be required to correct the interference at the users expense.

EMC Directive Statement

CE

Products bearing the CE Label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, the following European standards must be met:

EN55022 Class A - "Limits and methods of measurement of radio interference characteristics of information technology equipment"

EN55024 – "Information technology equipment Immunity characteristics Limits and methods of measurement".

EN60950 (IEC950) - "Safety of information technology equipment, including electrical business equipment"

Warning

This is a Class A Product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures to prevent or correct the interference.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.

Warranty

Sealevel's commitment to providing the best I/O solutions is reflected in the Lifetime Warranty that is standard on all Sealevel manufactured products. We are able to offer this warranty due to our control of manufacturing quality and the historically high reliability of our products in the field. Sealevel products are designed and manufactured at its Liberty, South Carolina facility, allowing direct control over product development, production, burn-in and testing.

Sealevel Systems, Inc. (hereafter "Sealevel") warrants that the Product shall conform to and perform in accordance with published technical specifications and shall be free of defects in materials and workmanship for life. In the event of failure, Sealevel will repair or replace the product at Sealevel's sole discretion. Failures resulting from misapplication or misuse of the Product, failure to adhere to any specifications or instructions, or failure resulting from neglect or abuse are not covered under this warranty.

Warranty service is obtained by delivering the Product to Sealevel and providing proof of purchase. **Return authorization must be obtained from Sealevel Systems before returned merchandise will be accepted. Authorization is obtained by calling Sealevel Systems and requesting a Return Merchandise Authorization (RMA) number.** The Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to Sealevel, and to use the original shipping container or equivalent. Warranty is valid only for original purchaser and is not transferable.

Sealevel Systems assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, or inability to use this product. Sealevel Systems will not be liable for any claim made by any other related party.

This warranty applies to Sealevel manufactured Product. Product purchased through Sealevel but manufactured by a third party will retain the original manufacturer's warranty.

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